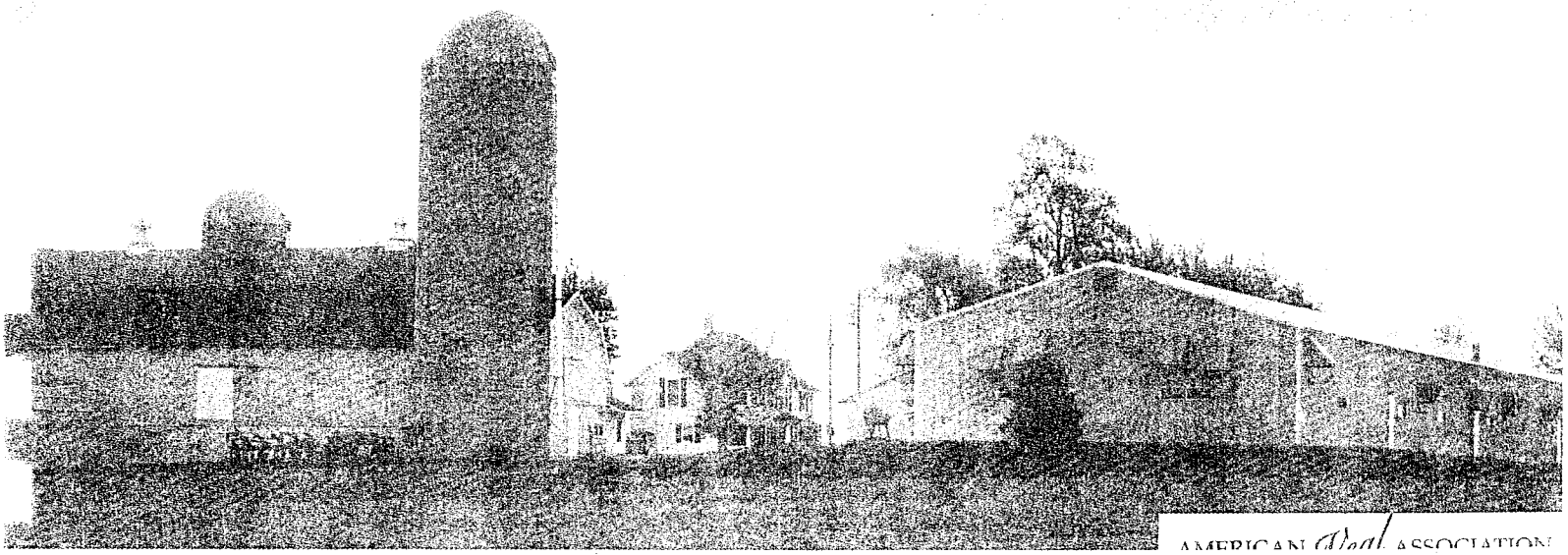
A Guide for

Care and Production

of Veal Calves



AMERICAN *Veal* ASSOCIATION

Table of Contents

Introduction

This is the sixth revision of the American Veal Association (AVA) Guide for the Care and Production of Special-Fed Veal Calves. These revisions (first edition in 1981) are the result of a continuous process as new information regarding husbandry and other technologies become available. Additionally, **changing consumer and industry needs have also influenced practices used in the care of veal calves.** Individuals who consider entering the veal industry, as well as experienced veal farmers, will find information in this Guide to aid in a successful production program. However, veal farmers must also rely upon other direct sources of information such as nutritionists, ventilation and facility experts, animal scientists, animal care specialists, and veterinarians. Updates are available directly from these specialists as well as from the AVA under auspices of the **VEAL QUALITY ASSURANCE PROGRAM** and other pro-active, service-based programs. Veal farmers continually avail themselves of all these sources. An additional purpose of this **Guide** is to provide general information to persons not involved in veal production, but who wish to have an overview of the methods used and the basic rationale for these methods.

A group of 100 young calves arriving at a veal farm is usually made up of calves from 50 or more dairy farms and several auction markets. This represents a challenge to any caretaker of animals and emphasizes the level of husbandry that must be provided to veal calves. Just as in the management of any animal enterprise, there are many practices that must be conducted properly if the enterprise is to be humane-based and profitable.

Veal is produced almost entirely from male calves of dairy origin. The following classes of veal calves are described by the United States Department of Agriculture (USDA):

Bob - calves less than three weeks of age and 150 pounds;

Special-fed - calves fed a milk-based liquid diet throughout the feeding period of 16 to 20 weeks. These calves are fed to a minimum finished weight of 350 to 400 pounds. They are also referred to as fancy, formula-fed, milk-fed, or nature veal calves;

Grain-fed - calves reared on feeding programs using pasture, grain, and hay.

Although the USDA description of special-fed veal calves gives a range of 350 to 400 pounds, calves at 18 to 20 weeks of age usually average from 450 to 500 pounds.

Farmers should be knowledgeable in the following aspects of veal production before they decide to enter the industry:

1. The **health, management and environmental needs** of veal calves;
2. **Nutritional requirements** and proper mixing, watering, and delivery of feed to the calves;
3. The **financial resources** needed to provide proper housing, environment, feed and health care throughout the calf ownership period;

4. The **obligations** of the veal calf caretaker for the proper care and well-being of calves under their management. All personnel on the veal farm have a responsibility for the health and well-being of the animals;

5. The **need for a valid, working veterinarian/client/patient relationship,** which is the basis for providing effective calf health maintenance and assuring a safe meat product for consumers;

6. Practices necessary to **protect surface and ground water quality** around the calf barns, and in areas where animal wastes are recycled;

7. The importance of **obtaining, operating and maintaining equipment and facilities** to protect the safety and health of animals and workers and of **training personnel** in the conduct of necessary practices.

The veal industry will continue to change as new research and technology develop and as consumer needs and industry goals change. Research programs conducted by commercial companies and universities can help guide the veal farmer in the areas of improved nutrition, environment, management, and veal product use. Improved techniques and new knowledge should be incorporated into management systems. Information about the care and management of veal calves is available from personnel and companies servicing the veal industry, Cooperative Extension Service specialists, and from the AVA; some of these resources are listed in Appendices A and C (pages 29 and 31) of this publication.

Buildings

Generally, the veal industry is centered in the northern U.S.; the location of the industry coincides with the dairy industry. The typical dairy herd calves throughout the year; and, therefore, bull calves are available at all times of the year for feeding as veal calves. **Enclosed housing allows for maintenance of proper ventilation, humidity and temperature regardless of the season of the year.** Rearing veal calves in outside yards and sheds has been attempted and is successful in some seasons in some geographical areas, but is not widely used. Some specific considerations about buildings are:

Location

The building should be located so there is ample room for future expansion of the veal enterprise. Prevailing winds are important from two aspects: (1) allowing sufficient ventilation for naturally ventilated barns (using curtains as part of the building walls), and (2) reducing the passage of air currents carrying undesirable odors through populated areas. In mechanically ventilated buildings, there is need for windows to reduce the amount of electrical lighting needed to allow **proper observation** of the calves and to provide a **pleasant environment for the calves.** In naturally ventilated housing, the curtains allow sufficient lighting.

Unloading/loading facilities for calves should allow access to the veal building from an **all-weather, readily accessible road.** These facilities should incorporate solid sides to reduce distractions of the calves moving through the passageways. The passageways should have gradual turns and be well lit with non-glaring fixtures.

Exterior Materials

A variety of materials can be used for the exterior of the building, but construction should be airtight in a mechanically ventilated barn. The insulation in the building should be of sufficient R-value to conserve heat; insulation is important in the ceilings of both naturally and mechanically ventilated buildings. Any windows should be of insulative grade similar to the R-value of the sidewall insulation. Exterior materials and construction should prevent the entrance of rodents, pets, birds, and other animals, which can be potential disease carriers (vectors); **such prevention of entry is a necessary part of biosecurity plans.**

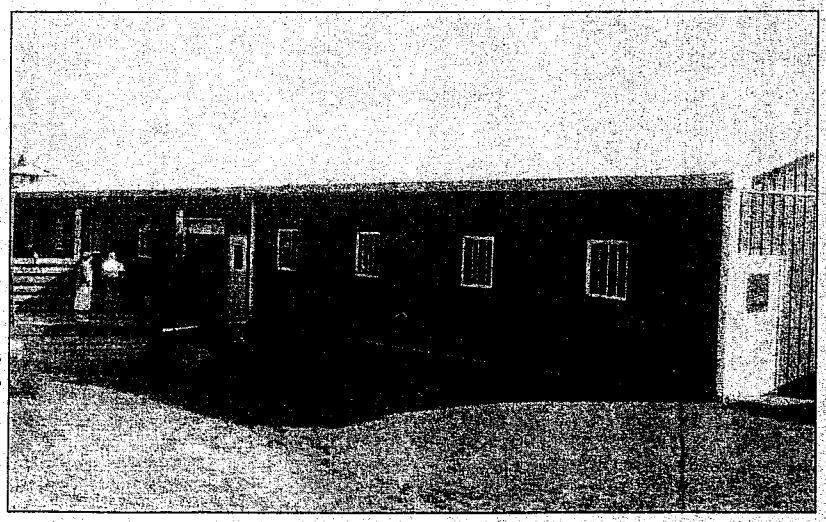


Photo courtesy of David Jackman

Interior Construction

The interior exposed walls should be of materials which are easily cleaned and sanitized and will stand up under repeated washing. Waterproof moldings and sealants should also be used to cover cracks and corners to allow removal of any organic material and provide for thorough sanitizing. The air ducts, ceilings, stall components and walls should also be of material that is **easily cleaned and which will dry completely after steam cleaning and sanitizing.** Any doors or windows should have screens to prevent entry from rodents, flies, birds, pets, etc.

Secured Entryways

Any passageways for either people or animals should be capable of being locked to prevent unwanted persons from entering. This is important for security of the animals, equipment and supplies, as well as for personnel who may be working in the building. Such security is also a necessary step in biosecurity plans to prevent entry of visitors and other subjects or objects which may bring disease microorganisms into the building. It may also be useful to have fencing around the entire facility with proper signs indicating that visitors are welcome at certain times (by appointment), or perhaps not at all. Appearance of the facility should also be considered: an attractive (painted, landscaped, neat) building gives a good impression. **It is important to maintain or improve the image of the veal industry by having an "open door" policy to visitors and those who are curious about veal production.** However, the possibility of introducing and spreading diseases within the calf housing area is something that also must receive utmost attention.

Animal Manure and Waste Management

The management of animal waste begins in the barn since there should be attention to transferring wastes from the barn to outside storage units. Below are some factors that must be considered, starting with the waste as it is generated in the barn:

In-barn Handling

It is not always possible or advisable to thoroughly wash floors or stalls when calves are in the barn, except in seasons where the excess humidity will not aggravate respiratory problems. Odors or gases should not be allowed to back up into the veal barn from the storage units. Venting or trapping of drain lines from barns to the storage units prevents hazardous gases from entering the buildings. Although some of the gases from decomposing materials are toxic to animals and humans, this is not usually a serious health problem with good management and proper venting and trapping.

Regulations/Good Neighbor Policies

It is important to plan the waste management component based on the following:

- State, county, and local laws and **regulations;**
- Locate the manure storage area to **prevent odors from moving toward either residences or barns when the storage facility is emptied;**
- **Provisions for emptying the storage units** should be made prior to using the buildings. This includes location of all equipment needed for handling and disposing of the wastes;
- In several states (e.g., **Pennsylvania's Nutrient Management Legislation and Regulations**), sufficient land (either owned or rented) must be available for disposal and recycling of the wastes (nutrients) generated by the number of animals in the enterprise. Some of the Pennsylvania Nutrient Management publications are listed in Appendix A (page 29) as examples. Included in these regulations is the **requirement that the land be of acceptable topography and soil type to prevent undue surface runoff or ground water contamination;**
- The daily fecal and urine waste production (lb/1000 lb live weight) of veal calves is 63 pounds is composed of two percent dry matter, and contains 8, 2, and 11 pounds per ton of nitrogen, phosphorous, and potassium, respectively. Wash-down water and other wash water can affect these numbers. Routine sampling can provide more precise numbers for particular barn, management system and feeding program.
- Presented in Appendix B (page 30) are some estimates of storage types and amounts per 200 calves in veal-production units for six months. This information must be considered in combination with the climate of the area so as to **assure the wastes are disposed of safely.**

Experts in the design of waste storage facilities are available for assistance and should be consulted. Manure storage and handling systems must be installed and operated to assure protection of workers, visitors, neighbors, and the environment. Although the **"right to farm"** philosophy still exists in many parts of the "agricultural" states, this concept is being challenged more frequently by private citizens, regulatory agencies, and environmental activists. However, the "right to farm" does not include the right to pollute water, land, or air resources. More information about waste management is available in publications from the AVA (Appendix C; page 31).

Ventilation, Humidity, and Temperature

Ventilation in veal buildings is a process for controlling several environmental factors by diluting inside air with outside air. Ventilation is a system that includes fans, inlets, and controls. Ventilating systems affect:

- Air temperature
- Moisture level
- Moisture condensation on surfaces
- Air speed across animals
- Odor and gas concentrations
- Airborne dust and disease organism level
- Combustion fumes from unvented heaters

As the ventilating system exchanges air, it brings in oxygen to sustain life. It removes and dilutes harmful dust and gases, undesirable odors, and airborne disease organisms and moisture. Experience has shown that if a system moderates summer temperature extremes and controls winter moisture buildup, the ventilating rate is sufficient to provide for most needs. High odor levels from under-floor manure storage may require higher air exchange rates. Since most veal facilities provide supplemental heat to maintain a warm environment, temperature fluctuations can be minimized, which is less stressful to the calf than a widely varying environment.

A basic ventilating process:

1. Brings fresh air into the building through planned openings.
2. Thoroughly mixes outside and inside air; picks up heat, moisture, and air contaminants, and lowers temperature, humidity, and contamination levels.
3. Exhausts moist, contaminated air from the building.

Failure to provide for any step of this process results in inadequate ventilation.

Ventilation Systems

Ventilating systems for veal buildings may be mechanical, natural, or a combination of the two. Mechanical systems force air through buildings with fans, while natural systems depend on wind and thermal buoyancy (hot air rises). Ventilating systems require carefully designed air inlets and outlets for proper air mixing and circulation inside the building. Either type of ventilating system needs an alarm and back-up system (generator or curtain drop) so that ventilation can be provided without interruption during an electrical power outage. This is particularly important during hot weather. Air movement into and out of the structure, for either natural or mechanical ventilation, is caused by the difference in pressure between the inside and outside of the building.

Mechanical ventilating systems are either negative, positive, or neutral pressure systems. Negative pressure systems exhaust air from the structure with wall-mounted fans that create a slight negative pressure or vacuum; the reduced pressure sucks air in through inlets. Positive pressure systems force air into the structure with fans. In veal barns, this is usually done with a fan connected to a tube where the increased pressure forces fresh air through the tube and out holes in the tube into the calf room. Neutral pressure systems in veal barns use a fan to force air through a tube into the calf room and exhaust fans to remove stale air from the building. Room air pressure is the same as outdoors. Mechanical ventilation is used where careful control of the environment is

needed, as for young animals in heated buildings, but calves can be successfully raised in either mechanically or naturally ventilated buildings.

Heat is supplied during cold weather to maintain the desired environment for veal production. During the first one to two weeks after birth, barn temperature of 60° F to 70° F is desired to help alleviate stress from the calves' experiences during auction and transportation. Since stalls in the veal barn do not provide bedding, a warm environment surrounding the calf provides comfort. As calves grow and mature, room temperature is dropped to 55° F by four weeks of age. With high energy costs, it is tempting for producers to reduce the ventilation rate in an effort to reduce heat loss from the barn. This must be avoided as reduced ventilation leads to poor air quality in the room, which in turn leads to respiratory problems and associated ear infections, poor growth rate, more medical treatment, and increased calf cull rates.

During hot weather, calves show signs of heat stress starting at 78° F. Providing air movement over the calf's body and evaporative cooling of the air are the two most common applications for reducing calf heat stress. Calves may be wetted for even more effective cooling on hot days as long as air movement is provided to help in the removal of heat and moisture from the barn. Circulation fans are sometimes used for portions of the barn to increase air movement in that area.

System Design Criteria

Airflow requirements vary with calf size and outside environmental conditions. Ventilating air must vary from just enough air to maintain air quality during very cold weather, up to a maximum rate to eliminate heat stress during hot weather. Retaining animal body heat in the building is important in cold weather to maintain desired room temperature and evaporate excess moisture. Even the best ventilating system occasionally fails to maintain desired building conditions during extreme weather conditions.

Design the system to provide at least three seasonal ventilating rates — cold, mild, and hot weather. Recommended rates for veal calves start at 10 cfm/100 pounds of calf for cold weather to 30 cfm/100 pounds during mild weather up to 100cfm/100 pounds during hot weather. Inlets are sized at 1.7 square feet of inlet area per 1000 cfm. An electronic controller is used to integrate the fans, heaters, and inlets into a system that responds smoothly to changing weather and calf room environment needs.

Cold weather ventilation provides oxygen, dilutes air contaminants such as ammonia and odor, and removes moisture. Ventilate at the cold weather rate when supplemental heaters are running. For the youngest calves, daily temperature fluctuations should be less than 5° F; for larger calves approaching finishing weight this can be increased to 10° F. Where unvented heaters are used, provide at least an additional 2 1/2 cfm continuous ventilating capacity per 1,000 btu/hour of heater capacity to remove combustion moisture and contaminant products. It is important to vigorously mix cold incoming air with warm air already in the building to avoid cold air falling as a draft on the calves. Inlet design has the most influence on reducing drafts.

Mild weather ventilation modifies temperature and removes moisture. Fans to provide this additional air are usually turned on by the ventilation controller temperature sensor when building temperature is a few degrees warmer than desired.

Hot weather ventilation reduces heat buildup and increases air movement over the calves. Temperature sensors turn on more fans when the indoor temperature exceeds a set level. The hot weather rate maintains room air temperature within 5° F of the outdoor temperature and provides high air velocities past the animals. Room air temperature can be lower than outdoor temperature due to evaporative cooling and thermal lag of building materials. If evaporative or wet-skin cooling is provided for calves, the hot weather rate may be reduced, but not to less than 50 cfm/100 pounds of calf.

Ventilation Example:

Determine the required cold, mild, and hot weather ventilating rates for a room housing 50 calves averaging 300 pounds.

Solution:

The required ventilating rates for a 300-pound calf during three types of weather are:

Cold weather = 10 cfm/100 pound x 300-pound calf = 30cfm/calf

Mild weather = 30 cfm/100 pound x 300-pound calf = 90 cfm/calf

Hot weather = 100 cfm/100 pound x 300-pound calf = 300 cfm/calf

For a negative pressure ventilation system, provide a cold weather fan that can exhaust 30 cfm/calf, a mild weather fan to add about 60 cfm/calf, and hot weather fans to provide another 210 cfm/calf. For the 50-calf room, four fans may be used with the smallest one providing the cold weather rate and all four together providing the hot weather rate. The smallest fan will have to provide airflow for the smallest 100-pound calves during cold weather and would have a minimum airflow rate of 500 cfm (10 cfm/100 pound; 100 pounds x 50 calves). This smallest fan is often variable speed, operated at 50 percent to 100 percent capacity. The maximum capacity of all four fans in the room would be 20,000 cfm for summer heat removal from fifty 400-pound calves (100 cfm/100 pounds; 400 pounds x 50 calves).

Insulation

Insulation is used in veal barn walls and ceilings to complement the ventilation system. By providing a warmer interior surface than outdoor temperature, condensation will be reduced, and the radiant heat loss from the calf to cold surroundings will be reduced. Recommended insulation R-values are up to 19 inches for walls and 35 inches for ceilings. Vapor barriers are needed to prevent moisture migration from ruining the insulation.

Troubleshooting

In addition to watching calf behavior and health, good growers will monitor calf room conditions with thermometers hung at calf level and hand-held humidity instruments. Knowledge of variations in conditions around the room and over time can help in troubleshooting ventilation system performance.

Temperature Fluctuations: As indicated, temperature fluctuations should ideally range less than 5° F per day for small calves and 10° F as calves approach finished weights. In mechanically ventilated buildings, this can only be accomplished by sophisticated electronic sensing and humidity (ventilation fan) controls. In naturally ventilated barns, wide daily fluctuations in temperatures necessitate an even closer monitoring of the opening and closing of side curtains to preserve barn heat. This does not mean the naturally ventilated barn cannot be properly managed, but it requires more frequent checking and adjustment than a mechanically controlled system. Again, much of the success of naturally ventilated barns depends on building placement and management expertise.

Alternative Power Generators: In case of power failure, particularly during either extremely cold or hot outside temperatures, it is important to have gas or diesel-powered generator systems available; alarm systems to monitor room temperatures and power outages are recommended. These back-up systems must also be checked and serviced periodically.

Individual Stalls

The preferred method of housing veal calves in the U.S., as well as in other veal-producing areas throughout the world, is individual stalls. The reasons for using individual stalls are generally cited as:

- **Less** potential **passage of diseases** from calf to calf;
- The calves can be given **individual attention** corresponding to the appetite, health, and other individual characteristics of the calves;
- There is less possibility of **fecal contamination of feed** supplies since the calves are tethered and facing in the same direction (toward feed buckets);
- **Health checks**, including body temperature monitoring and treatment, can be accomplished more thoroughly with less stress on the calves;
- Some **detrimental behaviors** such as cross-sucking and aggressiveness, which can result in physical injury, are prevented.

Some general considerations in individual stall construction are:

- Floors can be constructed of oak slats (laid crosswise, opposite the direction of the calf) or vinyl-coated expanded metal flooring. The latter results in cleaner calves and is **easier to clean and sanitize between groups;**
- The slatted floor should have spaces of 1 to 1.25 inches, with slat widths of 2 inches;
- The floor should be strong **enough to support heavier calves** to give them a feeling of secure footing and support;
- There should be an approximate **4 percent incline** from the rear to the front of the stall;
- The **stall floor should be elevated** to provide air circulation and to allow proper floor cleaning;
- Most facilities should have flooring **extending from the front of the stall to the interior wall**, or with a 12-inch or less rise between the barn floor and stall floor to allow calves to more easily enter and exit the stalls;
- The floor area under the stalls should be sloped and smooth for **easy, thorough washing**.

With regard to individual stalls, following are general guidelines for dimensions of stalls:

- In recent research, calves up to 425 pounds were housed in 24-inch wide stalls, with **little impairment of health or soundness.** However, the minimum stall width should be 26 inches for calves raised to average weights of 450 pounds;
- With the continued **increasing of end weights of calves**, new or renovated barns should have 28-inch stalls, with 30-inch stalls for calves averaging 500 pounds or more;
- The divider between stalls should be 24-30 inches extending from the front of the stall to just behind the front shoulder of the calf;
- **Minimum length** of stall flooring from the front of the stall to the rear should be 66 to 72 inches;
- **Tethers** should **be long enough to allow the calf** to stand, groom, eat, lie down and to rest in a natural, sternal-recumbent posture;
- **Tether length and neck size** should be **checked each second week** and adjusted if necessary;
- Self-adjusting fiber straps, which incorporate a swivel in the design, are preferred as tethers.

Individual Pens

Several producers have had success with "Dutch" individual pens, 30 inches wide and 72 inches long. Calves are tethered for the first six to eight weeks of age and then released in the pen. These stalls have barriers so that the calves cannot defecate in their feed buckets. Generally, calves in individual pens tend to **accumulate more manure on their hair coats** because of the four-sided pens. Although this dirt is removed at the packing plant before slaughter, it increases the amount of "barn" materials transferred to the packing plant.

Group Rearing in Pens

Group rearing of veal calves has not been successfully practiced in the United States but is used to a limited extent in parts of Europe. In some European communities, a combination of individual and group rearing will apparently be required by legislation. If group rearing is to be attempted, following are some of the most important considerations:

- The **size of pen** should be determined by calf market weight and number of calves, but a minimum of 20 square feet of floor space is required per calf;
- Calf performance (especially uniformity) is usually more desirable if **no more than 20 calves** are in one group;
- Aggression and negative social adjustment of calves may be **reduced by using smaller sub-groups**;
- **A head gate or hinged side gate** should be located in each pen to restrain individual calves for treatment;
- The sides of the pen can be wooden, metal or vinyl-coated expanded metal. It must be **easily cleaned**, and attention must be given to the **quietness of the materials** — metal could be a source of noise stress to the calves;
- Calves should have a **sufficient area to lie down and rest, away from the feeding and traffic areas.** This can be facilitated by providing some solid floor space with a type of bedding (although consumption of the bedding is a concern), with a portion of the floor slatted. It has been observed in swine housing that pigs tend to defecate and urinate on slatted floor areas and reserve the bedded, solid floor areas for resting;
- Feeding can be accomplished either by a trough-like arrangement or by **individual nipples** coupled with continuous or twice-daily offering of feed. The latter is the arrangement most frequently used in group rearing;
- **A limited source of fiber** (low iron content) tends to reduce some of the undesirable behaviors among calves but may increase the incidence of abomasal ulcers.

Perhaps the main advantage of group rearing is the enhancement of public image since individual stalls are a subject of public criticism directed toward the veal industry. However, there are undesirable group behavioral characteristics such as undue aggression, negative social adjustment, preputial suckling, urine drinking, mounting, and undue competition for feed. The most important negative production end points are uneven slaughter weights, grades, and generally lower carcass prices.

Combination of Individual and Group Rearing

As indicated, an individual stall coupled with the use of tethers is a subject of criticism directed toward the veal industry. Legislation enacted recently in some European countries stipulates that calves cannot be tethered in individual stalls or pens beyond eight weeks of age; group rearing must be used after that time. A system tested in the U.S. is the use of individual stalls and tethers to eight weeks of age, then releasing the calves so that they are penned in groups of five. The calves still have access to their original individual stalls but also have the opportunity to interact within the group of five. There is little change in the type of construction or layout of the veal barn with the exception that gates are used to confine the calves in groups of five to seven. It is interesting to note that the calves tend to return to their own original stalls when released either in large or small groups. In rearing methods as in any other animal management practice, it is important to make changes to enhance total animal well-being, rather than as a reaction to public image or criticism.

Feed Storage Area

A separate room for storage of feed, supplies, and mixing feed should be provided for each veal barn. Again, with the necessity for **tightened biosecurity restrictions**, the animal's feed supply must be protected. Some considerations are:

- The space should allow storage of large shipments of feed **without the possibility of the feed being damaged** by movement of feed or other items, washing of the area, contact by calves, etc;
- Particular attention should be given to **separate storage of different types of feeds** (e.g., starter and finishing feeds) to ensure the correct feed is fed to the right group of calves;
- The area should be **clean and dry, and rodent, pet, and fly proof;**
- Medications and related supplies should be **stored in a separate area,** which could be a partitioned section of the storage area, and properly labeled. However, dust particles from the feed and animal areas should be kept out of the office/medication storage areas.

Feed Mixing and Feeding

There has been a tremendous amount of research by feed companies, universities and other research entities into special-fed veal feeds. Recently, the National Research Council, National Academy of Sciences, updated the nutritional requirements for veal calves. Practically all milk replacers for veal contain a high **proportion of, or are completely made up of dairy products or by-products.** However, some feeds contain a limited amount of non-dairy components mainly because of economics. These feeds have also been well-researched and usually give acceptable results when compared with all-dairy replacers. Some considerations in mixing feed and providing it to the calves are:

- It is important to **closely follow the recommendations** for mixing feed (e.g., water temperature, mixing time) provided by the feed manufacturer and to adhere to the feeding schedule (amount of solids per feeding, dilution ratio with water, etc.);
- The powdered milk replacer is usually mixed with water of **temperatures from 120° F to 155° F**, with a minimum mixing time of five minutes;
- Sufficient water is then added to obtain the recommended total amount at a feeding temperature near the **calf's body temperature (101.5° F)**;
- Starter and finisher feeds should be 20-22 percent and 15-17 percent total protein, respectively;
- Even in buildings with non-corrosive water pipes, it is good practice to **allow water to run for a few minutes** before using it to mix feed or water calves;
- The **water supply** used to blend feeds and to water calves should be **fresh, free from contamination, and suitable for human consumption.** It should be tested periodically by a certified laboratory, particularly for iron, nitrate, and microorganism content.

Photo courtesy of David Jackman

Providing Water

Contrary to some popular "non-farmer" beliefs, **providing water is an important part of caring for veal calves.** There is not enough water in the feed to meet the calf's needs. Lack of water results in lower rate of weight gain and feed conversion, with a higher cost of weight gain. Some considerations about providing water are:

- **Water** should be provided, preferably with **electrolytes**, as soon as the calves arrive at the barn, to replace water and nutrients lost during transit;
- Providing water is more important as outside (ambient) temperature and calf weight increases. **The hotter the weather, the more water the calf requires;**
- In some cases, such as with young calves receiving medicated feed, **extra water may be withheld** to encourage the calves to consume all of the medicated feed being offered;
- Calves should be watered after feedings; several producers **water at noon and after the evening feeding;**
- Some **guidelines for water consumption** are for calves less than 200 pounds, offer 2-6 pounds of water; calves more than 200 pounds, offer 6-10 pounds, with more water being offered during hot weather.

Photo courtesy of David Jackman

More Aspects of Biosecurity Programs

Although there are references in most sections of this **Guide** referring to biosecurity, every farm should have a documented, written program for biosecurity. Biosecurity means simply applying every **possible effort to reduce the transmission of disease vectors** into the veal barn or between groups of calves in separate rooms or pens. Naturally, the most important disease carrier entering the barn is the calf; but, in addition, **any animal or person represents a possible disease carrier**. It has been shown that small animals, including cats and vermin, can carry various types of salmonella and other potentially dangerous microorganisms to calves and humans. Some aspects of an effective biosecurity program are:

- Have a written biosecurity program giving specifics of **how contamination and disease transmission are to be prevented**.
- **Emphasize your biosecurity program with every person who enters your farm** — feed service consultants, veterinarians, feed delivery persons, and especially all employees or helpers.
- Plan the order of work routine on the farm—**generally work from younger to older animals**. However, in some cases, younger calves may be a more serious source of disease than older calves. It is best to practice biosecurity (change boots, outerwear; have foot baths for each room available) between all calf rooms.
- Try to **control traffic** onto and around the farm–especially feed and animal trucks, which visit other farms.
- **Control rain and storm water drainage and location of the runoff**. Also prevent standing water areas, which can be a breeding ground for mosquitoes.
- **Service vehicles** (delivery trucks, manure handling equipment, etc.) **should never be driven through runoff, manure, or feed areas**. Access areas should be paved to minimize manure and mud accumulation.
- **Movement onto and within the farm** must be carefully controlled, especially vehicles hauling either live or dead animals. Dead or diseased animals should be removed from the main animal facility.
- **Vermin, bird, fly, and animal control programs** are extremely important, especially in areas of feed storage, handling, and via systems where are animals are housed.
- **Provide protective clothing when necessary**. Also provide a convenient place for service personnel to **clean boots and equipment** prior to leaving the farm.
- **Cleaning and maintenance schedules are important** to keep manure and body fluids from contaminating feed and water resources or being spread to animal housing areas. Porous feeding surfaces or surfaces beneath calf stalls can harbor pathogenic organisms. Rough concrete areas (where animals do not walk) should be resurfaced to make them smooth and allow more effective sanitizing.

With the high notoriety rate of **such disastrous, contagious diseases** as foot and mouth (FMD) and Bovine Spongiform Encephalopathy (BSE, mad cow disease), **biosecurity has become even more important aspect of animal management**. The swine and poultry industries have for many years practiced a higher level of biosecurity than most cattle (beef, dairy, or veal) enterprises.

Sanitizing of Feeding Equipment

Any build-up of solids in feeding equipment (mixers, distribution pipes or hoses, etc.) provides excellent mediums for **growth of most undesirable pathogens**. Some considerations are:

- The amount of heating equipment to provide hot water for feeding and for cleaning pipes should be assured **before starting the first group of calves;**
- **Buckets should be emptied and rinsed** (if not cleaned more thoroughly) after each feeding. An apparatus that empties all buckets in a row at one time is convenient and assures dumping of uneaten feed which in itself might may be a source of pathogen growth;
- **Milk solids should be rinsed** from all equipment that carries the milk replacer;
- Contamination and pathogen growth in feed distribution or mixing equipment can be a **"hidden" way of reinfecting calves.** It is difficult to establish a treatment regime since this reinfection continues until the equipment is cleaned and sanitized;
- **A cleaning and sanitizing protocol** for all feed equipment and distribution by treatments such as the following is recommended:
  - **Rinse milk solids** from the equipment using 110° F to 125° F water;
  - Use an **alkaline or chlorinated alkaline solution** to remove protein and fat deposits (water of 150° to 165° F; circulate in the tubing for 10 minutes);
  - **Rinse** using an **acid cleaner** at 95° F to 110° F to remove mineral deposits; an acid anionic sanitizer may be used after the acid rinse;
  - Allow equipment to **dry** and inspect for **thoroughness of cleaning;**
  - **Sanitize** just before using equipment with a 200 ppm hypochloride or 12.5 ppm iodophore solution;
  - Periodically, take apart milk line at the joints and check valves and dispenser; replace worn or cracked parts; discard old buckets and hoses.
- **Culturing may identify specific organisms**. Your consulting veterinarian may provide this service in addition to drug sensitivities, or this service can be arranged by your service representative.

Note: It is important that the cleaning temperature of the water never falls below 120°F or the fats will redeposit on the surfaces being cleaned. Temperature is more critical than time.

Photo courtesy of David Jackman

Personnel

The importance of all persons working with the veal calves in an enterprise can hardly be overestimated. The importance of each individual is recognized through the **AVA Quality Assurance Certification Program** in which persons (caretakers) are certified rather than calves, barns, facilities, or programs. Following are some important personnel considerations:

- All veal barn workers should have an **intensive on-site, in-barn training period of several weeks** in all aspects of veal calf husbandry; clinical signs indicating potential health problems to be recognized;
- All personnel should be trained to **move and speak in a manner that minimizes stress and excitement** of the calves. Soft background music tends to cover up some of the noises made in conducting routine work within the barn;
- Veal barn personnel or visitors coming in contact with other veal barns or animals should have a **change of clothing and use disinfecting foot baths** (deep enough to cover shoe soles and changed frequently) prior to entering the barn (showers between working in different veal barns may be indicated);
- All **personnel should be aware of biosecurity** precautions to prevent introduction and spread of disease vectors in calf barns. In addition, they should be familiar with precautions to prevent transfer of diseases from animals to humans and vice versa (termed zoonotic diseases). These precautions include **clean, hygienic personal care, and avoiding food or drinks for human consumption within the animal housing areas;**
- **All calf caretakers or others** working in the barn **should be knowledgeable** about the time schedule for each group of calves including the initiation and ending times of any medical treatments, transfer dates from starter to grower or finisher milk replacers, sources of alternative power, and **emergency numbers of the veterinarian, power company, calf managers, fire company, and other contacts;**
- **Evacuation procedures**, including emergency and routine "unloading" of the barn, should be familiar to those assisting with the veal enterprise.

Handling of the Calf at the Dairy Farm

There are several dairy calf management practices that should be accomplished at the dairy farm. These are listed below and are also summarized in other materials available from the AVA (see Appendix C; page 31):

- **Dairy herd health maintenance** through comprehensive vaccination programs improves the health of the calf;
- If the cow calves in a **dry, clean maternity stall**, the calf is more likely to be dried off and stimulated to suckle the cow;
- The calf should **receive two to four quarts of high-quality colostrum** as soon as possible after birth, and at least two quarts each at two additional times during the first 18 hours after birth;
- It is preferable to **have the calf suckle a nipple bottle containing colostrum** rather than using an esophageal feeder; nipple bottles and feeders must be cleaned and sanitized between calves;
- As soon as possible after birth, the **navel should be dipped or infused with a seven percent** tincture of iodine and tied off with a clean string; dipping or infusing is better than spraying;
- The calf should be housed in a **dry, bedded, sanitary** area from birth through sale time;
- The calf should be marketed between **three and five days of age, with good locomotion, a dry navel, and a dry, clean haircoat;**
- **Transportation** should be in a **covered truck or trailer**, particularly during extremely hot or cold temperatures;
- **The dairyman should not use vaccines on calves** which are intended for sale as bob slaughter, dairy-beef, or veal calves; antibiotics should not be used unless there is a very short pre-slaughter withdrawal period for the antibiotic on the product label. Bob calves may be slaughtered within 12-18 hours of sale.

Obtaining/Selecting Calves

The AVA and other groups have expended a great deal of effort to **communicate with the dairy industry regarding proper care of bull calves on the dairy farm** and how important health and quality of these calves is to the veal industry. Each person in the veal industry needs to communicate with the dairy industry whenever possible to bring about further improvement in the calves which represent **"raw material"** for the veal industry. Some considerations with regard to sources, purchasing, and transportation of incoming calves are:

- Calves can be purchased by the veal grower, by a purchase agent or broker, or any combination;
- There have been **"buying stations"** developed which transfer calves directly from the dairy farm to the veal farm. These systems reduce the exposure of calves to auctions and trucks;
- There must be close **communication between the grower and broker** regarding desired price, quality, weight, and timing of calves to be purchased;
- In some cases calves may be **marketed less than 36 hours of age**, which is not advisable. **Calves older than five days are less desirable** (unless the calves are five to six weeks old started calves) because of the increased exposure to diseases either on the dairy farm or through the marketing-transportation channels;
- Grower and broker **should agree** on the maximum length of transportation, number of auctions or other sources from which calves can be obtained, and any guarantees with regard to quality, soundness, age, weight, and livability of the calves;
- **Transportation details** such as responsibility for calves dying during transport, right to refuse calves of questionable health, and other factors must be agreed upon.

Age and Weight of Calves

The "preferred" veal calf coming into veal barns **weighs over 105 pounds and is three to five days of age.** Lighter-weight calves are also useful by veal producers especially when incoming calf price is high. These calves tend to have less body reserves than heavier calves, thereby having lesser ability to endure disease and require more intensive management. Lighter-weight calves (e.g., 85 pounds average) will require a feeding period at least one to two weeks longer than heavy calves.

Calf Quality-Health Indicators

It is difficult to obtain "ideal" calves either directly from a dairy farm or through auctions or buying stations. However, there are indicators that can be used to judge the value of incoming replacement calves:

- **Fatness:** average body fatness or condition indicates that the calves had adequate nutrition;
- **Navels:** navels should be dry; in some cases evidence of iodine may be seen on the navel and surrounding hair;
- **Cleanliness:** shows that the calves have had responsible care on the dairy farm and during transportation/marketing;
- **Alertness/ambulatory condition:** calves should be alert and capable of walking without assistance;
- **Absence of scours:** calves should not show any indication of scours or dehydration;
- **Respiratory condition:** calves should show minimal if any nasal discharge, should not have red or runny eyes, and have a normal respiration rate;
- **Physical impairments:** calves should be checked for physical impairments such as hernias, swollen joints, navel infections, and other permanent defects which will affect subsequent health and performance. If these defects are relatively minor, the calf may perform satisfactorily, but the broker or buyer of the calves should be notified of the occurrence of these defects.

Keeping and Using Records

Records on any livestock enterprise, or any business, are needed to document performance and to identify changes **necessary in order to improve profitability or performance.** Another very important reason for keeping records of veal production cycles is to **document calf health, medication use, and withdrawal times in case of a violative carcass residue.** The different types of records include health, medication, weight gain, feed consumption, ventilation, humidity and temperature levels, and perhaps most importantly, the production factors that directly reflect profitability. Some of the more important information to be recorded is:

- **Incoming calves:** Source, purchase price, condition, weight, rejects, and other information about the new group of calves;
- **Feed records:** The lot number, supplier, manufacturer, etc. should be retained along with feed tags or notes of any medications either in the feed when purchased or added to the feed during the mixing/distribution process;
- **Group medication records:** Specific days of the feeding cycle when group oral medications were given should be carefully recorded and should include the health impairment causing the medication to be fed, dosage in the tank and per calf, type of medication, and the length of time the group medication was fed. **Group samples should be retained** and identified with batch numbers, dates fed, and the identification of the calves receiving the feed for at least six months after slaughter;
- **Health records:** Ideally, any physical impairment of any calf should be recorded. These include manure consistency, feed refusals, days sick, body temperatures, hemoglobin levels, and cause of death or disposition if culled;
- **Medication records:** The Food and Drug Administration (FDA) set strict requirements for drug withdrawal periods, record keeping, and the need for prescription of most medications (which are not available over the counter) by a veterinarian. **Animal identification, diagnosis, medications used, treatment dates, dosages, notes on veterinarian communications, person administering medications, and withdrawal shall be included as part of the record for each calf.** These records should be maintained for at least 12 months after the treated calves have been marketed;
- **Prescription medication records:** Records must be labeled with adequate instructions, including dosage information, **withdrawal** time, any possible adverse reactions or interactions with other drugs, and the **veterinarian's name, address and phone number;**
- **Production records:** All production factors, including **weeks in the cycle, feed per calf, death loss, weights in and out, carcass grade, price, percent of rejects and trimmed carcasses,** should be recorded.

Using the Records

Not only should records be kept but also **used to evaluate the weak points in a production program.** Changes in management practices should be made to improve performance and health of the calves and to reduce production costs and health impairments. In addition to the records forms available from feed manufacturing/distribution companies, veterinarians, and private consultants, there are several record keeping systems given in the AVA's Quality Assurance Certification Program.

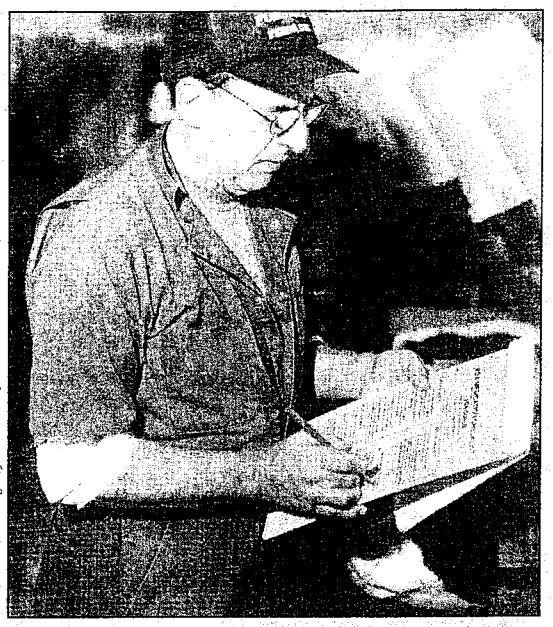


Photo courtesy of David Jackman

Vaccination Programs

The producer, in conjunction with the consulting veterinarian, the feed manufacturer's representative and animal agricultural professional, should plan vaccination programs. Selection of vaccines, timing, and cost are all-important considerations. Disease prevalence varies in particular geographical areas, varies due to the season, and varies in the cattle herds at large where the veal calves are obtained. Therefore, no single immunization program will necessarily fit all veal operations. The veal producer needs to use the advice of agriculture advisors to achieve the most cost-effective immunization program.

- The use of vaccines is part of risk management. **Vaccines do not eliminate all disease nor do they protect all animals in the face of overwhelming challenge** or severe environmental stress.
- A vaccination program is designed to **prevent disastrous disease outbreaks in the herd** and **improve herd health** and may or may not improve the performance of individual animals.
- The four **viral disease agents** most often considered in a vaccination program are bovine viral diarrhea **(BVD)**, infectious bovine rhinotracheitis **(IBR)**, parainfluenza type 3 **(PI3)**, and bovine respiratory syncitial virus **(BRSV)**. In nearly all cases, these viruses should be part of the immunization program.
- In most cases, it appears that calves respond best to the viral vaccines if given a **few days to one week after they arrive at the farm**. Due to stress and other physiological factors, animals do not respond as well to vaccines given upon arrival at the farm. Generally, the viral vaccine is **repeated two to three weeks** after the initial dose.
- Modified live vaccines **(MLV) produce a broader spectrum of protection** and generally cost less than killed vaccines. In some cases, only one dose of a MLV is necessary or recommended. **MLV do require special handling** and once a vial is mixed, it must be used within a few hours.
- **Intranasal vaccines** are a special class of MLV. They cause minimal stress, produce very rapid nonspecific protection in the upper airway, and do not interfere with the use of other vaccines at a later date. Frequently, they are given to veal calves shortly after arrival on the farm.

- **Killed vaccines are safe for all classes of animals.** If aseptic practices are followed, a few doses at a time can be used from a bottle. They tend to be more expensive, may cause some animals to reduce their dry matter intake for a day or two, require a booster dose 2-4 weeks after the initial immunization, and tend to have a slower immune response.

- **Bacterial agents** may be included in a vaccination program. These are more **controversial in their cost effectiveness.** Their use by the veal producer should be evaluated on an individual farm basis. Some bacterial vaccines that may be useful in certain farm situations include: *Clostridium perfringens type C and D, E coli, Salmonella spp, Pasturella (Mannheimia) and Haemophilus.*

Calf Health – A Team Effort

Keeping veal calves healthy was once considered strictly a medical concern. As we have learned more about the complex relationships between infectious diseases, immunology and nutrition, **veterinarians, agricultural engineers, managers, and nutritionists are working together to ensure animal health.** As a result, supplementing feed with vitamins, minerals, medications, and other additives at critical times in the production cycle has become the newest weapon in the war against disease. Economic losses resulting from undue stress, interference with immunocompetency, and preventable disease introduction and (or) spread occur frequently in veal production. Unfortunately, the calf's body defense system becomes less effective when it must cope with inadequate nutrition, overcrowding, poor ventilation, or other sources of stress. **The good news is that many of these adverse situations can be reduced or avoided all together by applying good nutrition and environment (facilities)** which has always been part of sound medical/veterinary care. It is important also to consider the definition of a **valid veterinary-client-patient relationship (VCPR)** in maintenance of calf health in an approved, legal manner (Appendix D; page 32).

Growth Promotant (Implants)

Growth promotant implants have been approved for use in beef cattle (in both calves and feedlot cattle) for over 40 years. The types of implants have changed, primarily a reflection of the research that has been conducted with different compounds and their effects on growth and feed efficiency. **There is a difference in the diets of most beef cattle and special-fed veal calves.** The latter do not ordinarily consume forages (or other fibrous feeds), and therefore are termed **pre-ruminant**, and are considered essentially a different species from beef cattle, which consume fiber-containing diets. Therefore, the Food and Drug Administration (FDA) has not approved the use of any implanted subcutaneous growth promotants in veal calves. **Growth promotant implants should be considered unapproved drugs and should not be used in special-fed veal calves.** Veterinarians can prescribe under extra-label (AMDUCA) drugs that have therapeutic value in animals. However, implants cannot be prescribed for use under the extra-label provisions in veal calves since implants have not been shown to have measurable therapeutic (health-improving) value in any animals. Therefore, growth promotant implants should not be used in veal calves of any age or on any type of management system unless they are being fed for "red" veal purposes, and hence have a relatively high intake of fibrous feeds. In that case, they are then defined as beef cattle, although slaughtered or perhaps harvested at similar ages and weights as special-fed veal calves. It should also be mentioned that implants in veal calves have given less increases in weight and efficiency of growth in research trials than the same implant used in beef cattle.

General Transportation Considerations

Transporting calves to and from the veal production facility **can be a source of undue stress, injury, and possibly death if not conducted properly**. Fortunately, most professionals handling or transporting calves realize the importance of their actions and conduct themselves appropriately. Following are some general transportation guidelines:

- **Calves should not be crowded** too tightly in shipment; three to three and a half square feet should be allowed per 125 pounds bob calf, with seven to eight square feet for finished calves. There is more possibility of calf injury with underloading than with proper loading densities. Calves should be gated in the truck to prevent undue movement, with no more than 40 calves contained in the same compartment;

- Caution and common sense of **air vent placement and positioning** is required especially in periods of **extreme temperatures** (note Wind Chill Index; Appendix E; page 32). Note also that information is available on managing cattle in hot summer weather (Appendix C; page 31);

- **Minimizing transport time,** checking and realigning animals (if necessary) shortly after departure, **checking, smooth starting, driving and stopping, training and supervision** of personnel are highly important;

- **Loading density** cutbacks of up to 25 percent should be considered if the weather is extremely hot and humid. However, in such extremely hot/humid conditions, transportation probably should be delayed until temperature decreases (note guidelines for managing cattle in hot weather cited in Appendix C; page 31);

- **Distressed or injured animals** must not be loaded for transport **unless special provisions** are made to assure loading, transport, and unloading will not cause additional suffering or injury. It must be realized that sometimes calves are stressed but recover; "non-ambulatory" conditions may not be permanent;

Photo courtesy of Michelle Kunjappu, Lancaster Farming

- Finished calves **should not be fed within 12 hours of transporting** unless the transportation time will be very short. Substituting electrolytes for the milk replacer prior to shipment can improve the well-being of the calves during the loading, transport, and unloading process;

- **Strict biosecurity measures** should be used when transporting calves that are going to veal barns for subsequent feeding. This includes **thoroughly sanitizing and disinfecting** not only the trucks used to transport bob calves, but also the receiving areas at both the loading and unloading docks.

It should be emphasized that **transporting of livestock, in view of the public, can be a source of severe public criticism.** Therefore, any apparent inhumane treatment of animals in transport can result in an even further undesirable image of the animal industries.

Loading and Unloading

The **experience of personnel** assisting with calf handling is extremely important, as is the close supervision of personnel during the unloading, stalling, and loading processes.

- Calves should be loaded and unloaded so as to reduce injury and stress. **Any change or disturbance in their surroundings such as noises, movement of objects, flashes of light, or even breezes should be avoided** since calves in unfamiliar situations are easily frightened. Canvas slappers or other devices to move calves should be kept to a minimum to avoid excitement or injury to calves;

- Use of **electric prods** is unacceptable except in transport to encourage animals that are down to get up;

- **Ramps and alleyways** should have gradual turns that do not impede movement or cause injury, have solid walls, non-skid floors, and be properly lit;

- **Docks should be level** with the trucks to allow the calves to step safely onto and off the truck, be **non-skid to provide safe footing, and have sides high enough** to prevent calves from jumping off;

- Any doors or other passageways should be sufficiently **wide to permit calves to pass easily** without bruising or injury;

- Inside the barn, **the stall or pen flooring should not be greater than 12 inches above the ground floor** upon which the calves enter and exit.

Auction and Buying Station Facilities

Not only do these facilities affect the outcome of calves in the veal barn, **but any mistreatment of calves is also a probable topic for public criticism.** Following are some considerations:

- **Personnel working with calves should be instructed** in acceptable, humane handling techniques. Educational materials are available to ensure the employees are aware of proper calf handling techniques;

- **All floors, ramps and alleyways should be paved, properly drained, scored** to prevent slipping and gently graded (e.g., 2.5 inches elevation per yard) to provide good footing;

- **All ramps and alleyways should be well lit and properly ventilated;** calves should be protected against extreme weather conditions;
- Calves kept for more than 12 hours must be **fed and watered;**
- There should be **no protruding objects** (nails, bolts, sharp corners) that could injure calves or cause discomfort;
- Buying station and auction facilities should **allow separation of distressed or unhealthy calves** from healthy calves, and all areas should be regularly cleaned, sanitized and provided with fresh bedding;
- Immediately after unloading from the dairy farm or from the auction barn, **calves should be penned and handled so as to minimize discomfort and excitement;** sufficient space should be available to allow all calves to rest at the same time.

Handling at the Processors

Many of the same precautions given for loading, unloading, and transporting at auctions also pertain to handling at the processor. Following are some specific considerations:

- Unloading areas should be **maintained** in a sanitary condition, provide secure footing, and not cause injury to animals;
- Equipment should be available to **off-load non-ambulatory animals;** the preferred method is to euthanize or stun them on the vehicle;
- Holding areas should be provided to **prevent overcrowding, permit segregation** of different types of animals, and **enable animals to lie down;**
- Priority must be given to slaughter of injured or disabled calves; **hoisting of conscious calves is not permitted.** Animals that are slaughtered in accordance with established religious laws (without stunning) should be properly restrained, and the slaughter must be carried out by qualified persons using the proper equipment;
- Holding pens should provide **access to clean water** with frostproof waterers.

Although the veal industry is fortunate to have numerous processors available, attention must be given to providing acceptable calf well-being at the processor. **The producer receives payment basically on the weight and quality of the carcasses resulting from the calves he/she has raised.** Therefore they have a bonafide interest in the handling of the calves at the processing plant, particularly if any of the conditions at the processor causes a reduction in carcass value.

Disposing of Mortalities

Because of potentially disastrous diseases such as Bovine Spongioform Encephalopathy (BSE), **rendered ruminant products cannot be recycled as feeds through other ruminant animals.** This has brought about a large increase in cost of disposal of mortalities through normal channels. One of the more cost-effective and environmentally sound methods to dispose of animal mortalities on the farm is through composting. Although composting of animal mortalities has been widely accepted, local regulations should be consulted before composting. Some guidelines for successful calf mortality composts are: Mortality processing and disposal is usually regulated by either local or state agriculture environmntal quality or health departments.

- There are three basic methods for composting: Bin (which is usually the most appropriate for calves and other small animals in a farm situation); Windrow/static pile composting; and Mini-composters;
- The **location** is important and should consider **protection of ground and surface water, reducing the risk of disease transmission from farm to farm or within farm.** Controlling of nuisances such as flies, vermin, and scavengers is essential, and air quality is important — objectionable odors should not reach neighbors;
- Composting has a favorable public perception (recycling and organic-based), but still should not be in public view or "advertised;"
- Since composting is biological activity (anaerobic bacteria in the animal zone and aerobic bacteria in the biofilter zone), it is important to realize that the bacteria formed are naturally occurring; one bacterium can increase into zillions of bacteria within 24 hours;
- There are four limits on growth of bacteria, which in turn determine the effectiveness of composting;
    - There should be proper nutrient balance (acceptable range 20:1 to 35:1 of carbon: nitro gen ratio). Most carcasses are 5:1, and a bulky agent such as sawdust is 140:1. Therefore, on a weight basis there should be five times as much sawdust as carcass in weight. Covering the carcasses with sawdust helps control vermin and odor release.
    - Temperature is the best indicator of how effective a compost pile is operating and should range between 110° F and 150° F. Compost temperatures are self-limiting since when pile temperature exceeds 160° F, the heat generated will begin to destroy all the bacteria, thereby causing the pile to cool down.
    - **Moisture content should range between 45 and 60 percent,** which means that many times moisture will have to be added to have a successful compost pile.
    - In order for successful composting, **the pile should be porous and have good "air quality."** Carcasses are not porous, which means that the carbon or bulky pile additive must be porous and allow air movement. Sawdust, straw, peanut hulls, and grass clippings have been used successfully; chopped soybean stubble, chicken litter, finished compost, and other materials have been used to a limited extent.

There are some excellent publications available on composting methods which should be consulted (Appendix A; page 29).

Summary

In summary, everyone involved in the veal industry has an **interest in transporting veal calves, both incoming and finished, humanely, with reduced stress, and with minimal injuries** that affect carcass value. Stress on finished calves being moved from the barn or onto and off the truck at the packing plant can cause bruises, darkening of muscle from stress, and other penalties that can be assessed to the calf owner or the contract feeder. Therefore, even though it is in everyone's interest to make certain that handling and transport of calves is accomplished without injury, it is particularly the **veal grower who stands to lose or gain** depending on the value of each calf's carcass at the processing plant.

In the late 1980s, when the first veal quality assurance programs were initiated, the reminder to those in the industry producing and processing veal calves was **"you are not just feeding calves — you are feeding families."** Other standards by which personnel within the veal industry have agreed to abide are given within the Quality Assurance Certification Program.

The changes that have been made in the industry over the past several years have been **pro-active not only from the standpoint of the producer and the consumer,** but also have been **pro-active with regard to improving the plight of the animal** within veal feeding systems. This **Guide** is an overview of the primary management and production practices applied to veal calves that must be considered by each producer. Veal growers welcome questions about veal production, and can respond to such inquiries with science-based answers. As indicated previously, research is ongoing in every phase of the veal industry, just as in any other farm animal enterprise. The readers of this **Guide**, whether directly involved in the veal industry or simply wishing to know more about raising veal, should consult the technical bulletins and other information available from the American Veal Association, Extension Services, Department of Agriculture; American Veterinary Medical Association; American Dairy Science Association; American Association of Bovine Practitioneers; American Society of Animal Science; American Registry of Professional Animal Scientists, and others.

APPENDIX A

Examples of nutrient management publications (Commonwealth of Pennsylvania):

- Nutrient Management Legislation in Pennsylvania: A Summary of the Final Regulations
- Nutrient Management Planning: An Overview
- Making Nutrient Management Work for You
- Nutrient Management Plan Writing Workbook
- Using the Penn State Manure Analysis Report
- Nutrient Management Approach for Pennsylvania
  - Nutrient Decision-Making
  - Plant Nutrient Stocks and Flows
- Managing Phosphorus for Agriculture and the Environment
- Estimating Manure Application Rates
- Field Application of Manure: A Supplement to Manure Management for Environmental Protection
- Veal Calf Manure Management, PDER

Above available from Cooperative Agronomy Extension, College of Agricultural Extension, The Pennsylvania State University, University Park, PA.

Composting Swine Mortality Module. National Pork Producers Council, 1776 N. W. 114th St., Clive, IA

Nutrient Requirements of Dairy Cattle (7th Edition). National Academy of Sciences, 2101 Constitution Ave. N.W., Washington, D.C.

Following publications are available from the Bovine Alliance on Management and Nutrition, c/o American Feed Industry Association, 1901 Wilson Blvd., Arlington, VA:

- A Guide to Colostrum and Colostrum Management for Dairy Calves
- A Guide to Dairy Calf Feeding and Management
- A Guide to Modern Calf Milk Replacers
- An Introduction to Infectious Disease Control on Farms
- Biosecurity on Dairies
- Biosecurity of Dairy Farm Feedstuffs

APPENDIX B

Approximate Size of Manure Systems for 200 Calves for 6 Months[a]

System	Effective volume	Maximum depth	Surface area	Settling tank	Aeration pumps
1. Storage tank or pit (covered)	25,700 cu ft	10 ft	Flexible w/depth	–	–
2. Storage basin (uncovered, no runoff)	25,700 cu ft	10 ft[a]	Flexible w/depth	–	–
3. Naturally aerated basin	3-5 acre ft	3-5 ft[c]	1 acre	–	–
4. Naturally aerated basin w/settling tank	1.5-2.5 acre ft	3-5 ft[c]	0.5 acre	870 cu ft	–
5. Mechanically aerated basin	25,700 cu ft	20 ft[c]	Flexible w/depth	Optional	6.0 hp
6. Mechanically aerated basin	25,700 cu ft[b]	20 ft[c]	Flexible w/depth	–	5.7 hp
7. Anaerobic basin	34,560 cu ft	20 ft[c]	Flexible w/depth	–	–
8. Anaerobic basin w/settling tank	25,700 cu ft[b]	20 ft[c]	Flexible w/depth	870 cu ft	–

[a]Veal Calf Manure Management, Department of Environmental Resources, Commonwealth of Pennsylvania, Harrisburg, PA.

[b]Minimum volume for any tank or basin.

[c]Allow at least 2 feet for freeboard and rainfall.

APPENDIX C

SOME SOURCES OF ADDITIONAL INFORMATION

Fact Sheets from the American Veal Association, 1500 Fulling Mill Road, Middletown, PA.

Recommended Code of Practice for the Care and Handling of Farm Animals: Veal Calves Canadian Agri-Food Research Council (CARC), Heritage House, No. 60, Ottawa, Ontario, Canada.

Judicious Use of Antimicrobials for Dairy Cattle Veterinarians and Judicious Use of Antimicrobials for Beef Cattle. Center for Veterinary Medicine, Food and Drug Administration, Rockville, MD.

Extra-Label Drug Use (ELDU). AMDUCA Guidance Brochure. Am. Vet. Med. Assoc. 1931 N. Meacham Rd., Schaumburg, IL.

Coping with Summer Weather: Dairy Management Strategies to Control Heat Stress. Agric. Exp. Station and Coop. Ext. Svc., Manhattan, KS.

Midwest Plan Service (MWPS):
Mechanical Ventilating Systems for Livestock Housing (MWPS-32)
Natural Ventilating Systems for Livestock Housing (MWPS-33)
Heating, Cooling and Tempering Air for Livestock Housing (MWPS-34)

Natural Resources, Agriculture and Engineering Services (NRAES)
Special-Fed Veal Production Guide (NRAES-17)

APPENDIX D

VETERINARIAN-CLIENT-PATIENT RELATIONSHIP (VCPR)

A VCPR exists when all of the following conditions have been met:

1. The veterinarian has assumed the responsibility for making clinical judgments regarding the health of the animal(s) and the need for medical treatment, and the client has agreed to follow the veterinarian's instructions.

2. The veterinarian has sufficient knowledge of the animal(s) to initiate at least a general preliminary diagnosis of the medical condition of the animal(s). This means that the veterinarian has recently seen and is personally acquainted with the keeping and care of the animal(s) by virtue of an examination of the animal(s) or by medically appropriate and timely visits to the premises where the animal(s) are kept.

3. The veterinarian is readily available for follow-up evaluation, or has arranged for emergency coverage, in the event of adverse reactions or failure of the treatment regimen.

APPENDIX E

WIND CHILL INDEXES

(For Cattle with Summer Coats)

WIND SPEED	ACTUAL TEMPERATURE F°						
MPH	-10	0	10	20	30	40	50
10	-20	-10	0	9	19	29	39
20	-37	-27	-17	-7	2	12	22
30	-52	-43	-33	-23	13	-3	6
40	-60	-50	-40	-30	-20	-10	0

Veal Guide Review Committee

Revision Editor:

Lowell Wilson, Ph.D., PAS
Professor Emeritus
Department of Dairy and Animal Science
The Pennsylvania State University
University Park, Pennsylvania

Review Committee:

Dale Bakke
Director of Technical Services
NRV/N Alto Company
Ixonia, Wisconsin

Daniel O'Reilly
V.P. for Procurement and Processing
Catelli Brothers
Shrewsburg, New Jersey

Dan Catherman, Ph.D., PAS
Director of Technical Services
Strauss Veal Feeds, Inc.
Watertown, Wisconsin

Jeffrey Pyle, DVM
Manchester Veterinary Clinic and Supply
North Manchester, Indiana

Michelle Cornman
VQA Program Coordinator
American Veal Association
Middletown, Pennsylvania

Janusz S. Sowinski, PAS
President
Animix
Juneau, Wisconsin

R. Dean Elliott, DVM
Troy Veterinary Clinic
Troy, Pennsylvania

Eileen Fabian Wheeler, Ph.D.
Department of Agriculture and Biological Engineering
The Pennsylvania State University
University Park, Pennsylvania

Robert E. Graves. Ph.D., PE
Department of Agriculture and Biological Engineering
The Pennsylvania State University
University Park, Pennsylvania

Dr. David R. Wolfgang, VMD, DABVP
PADLS Field Investigation Unit/Extension
Veterinarian Department of Veterinary Science
The Pennsylvania State University
University Park, Pennsylvania

Veal Quality Assured

American Veal Association
Veal Quality Assurance Program
1500 Fulling Mill Road
Middletown, PA 17057
Phone: 717/985-9125
Fax: 717/985-9127

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